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FLOOD INSURANCE STUDY

ORIGINAL
COMPLETED
48

CITY OF WESTMINSTER, CALIFORNIA
ORANGE COUNTY

MARCH 30, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER-060237

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1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study report has been prepared to revise and update a previous Flood Insurance Study for the City of Westminster, Orange County, California, which was published on August 8, 1978. This information will be used by Westminster to update existing flood plain regulations as part of the regular program of flood insurance by the Federal Emergency Management Agency. The information will also be used by local and regional planners to further promote sound land use and flood plain development.

1.2 Coordination

A meeting was held on November 26, 1979, to review the hydraulic overflow delineations for Santa Ana River. Representatives of the Federal Emergency Management Agency, the study contractor, the Orange County Environmental Management Agency, and the California Department of Water Resources were in attendance.

An intermediate coordination meeting was held on February 1, 1980. Representatives of the Federal Emergency Management Agency, the study contractor, the California Department of Water Resources, and the Cities of Costa Mesa, Fountain Valley, Garden Grove, Huntington Beach, Santa Ana, and Westminster were in attendance. No technical changes were made at that time.

The results of this study were reviewed at a final community coordination meeting held on September 16, 1980. Attending the meeting were representatives of the Federal Emergency Management Agency, the study contractor, the City of Westminister, and the surrounding communities. This study incorporates all appropriate comments, and all problems have been resolved.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, for the Federal Emergency Management Agency, under Inter-Agency Agreement Nos. IAA-H-19-74 and IAA-H-7-76, Project Order Nos. 13 and 14, respectively. This work, which was completed in April 1980, covered all significant flooding sources affecting the City of Westminster.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Westminster, Orange County, California. The area of study is shown on the Vicinity Map (Figure 1).

Floods of the 100-year recurrence interval for Santa Ana River were studied in detail from the Pacific Ocean to Imperial Highway.

Several parcels of unincorporated Orange County land within Westminster were not included in this study.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1985.

2.2 Community Description

Westminster is in southern Orange County, in southern California. The city is approximately 4 miles inland from the Pacific Ocean. Westminster is bordered by the City of Garden Grove to the north and east, the City of Fountain Valley to the south, the City of Huntington Beach to the southwest, and the unincorporated areas of Orange County to the west and northwest.

Santa Ana River flows southwesterly through Orange County and passes approximately 3 miles to the southeast of Westminster.

The topography of Westminster is gently sloping lowlands, with elevations ranging from 25 feet in the southwest to 55 feet in the northeast.

Elevation, topography, and proximity to the Pacific Ocean influence the climate of the Santa Ana River basin. The Westminster area has a semiarid, subtropical climate. Summers are long, hot, and dry, with temperatures often exceeding 90°F. Winters are short, cool, and mild, with only occasional frost. Relative humidity is variable, and ranges from 40 to 70 percent in the winter, and from 10 to 20 percent in the summer.

Soils in the Westminster area are mainly fine sands and silts, with accumulations of peat and organic soils for several square miles north and inland of the Santa Ana River mouth.

Dense, shrubby chapparal vegetation dominates the higher elevations east of Westminster, while less dense coastal sage-scrub vegetation covers the lower areas. Grasses and low herbaceous plants are dominant along the undisturbed valley floor.

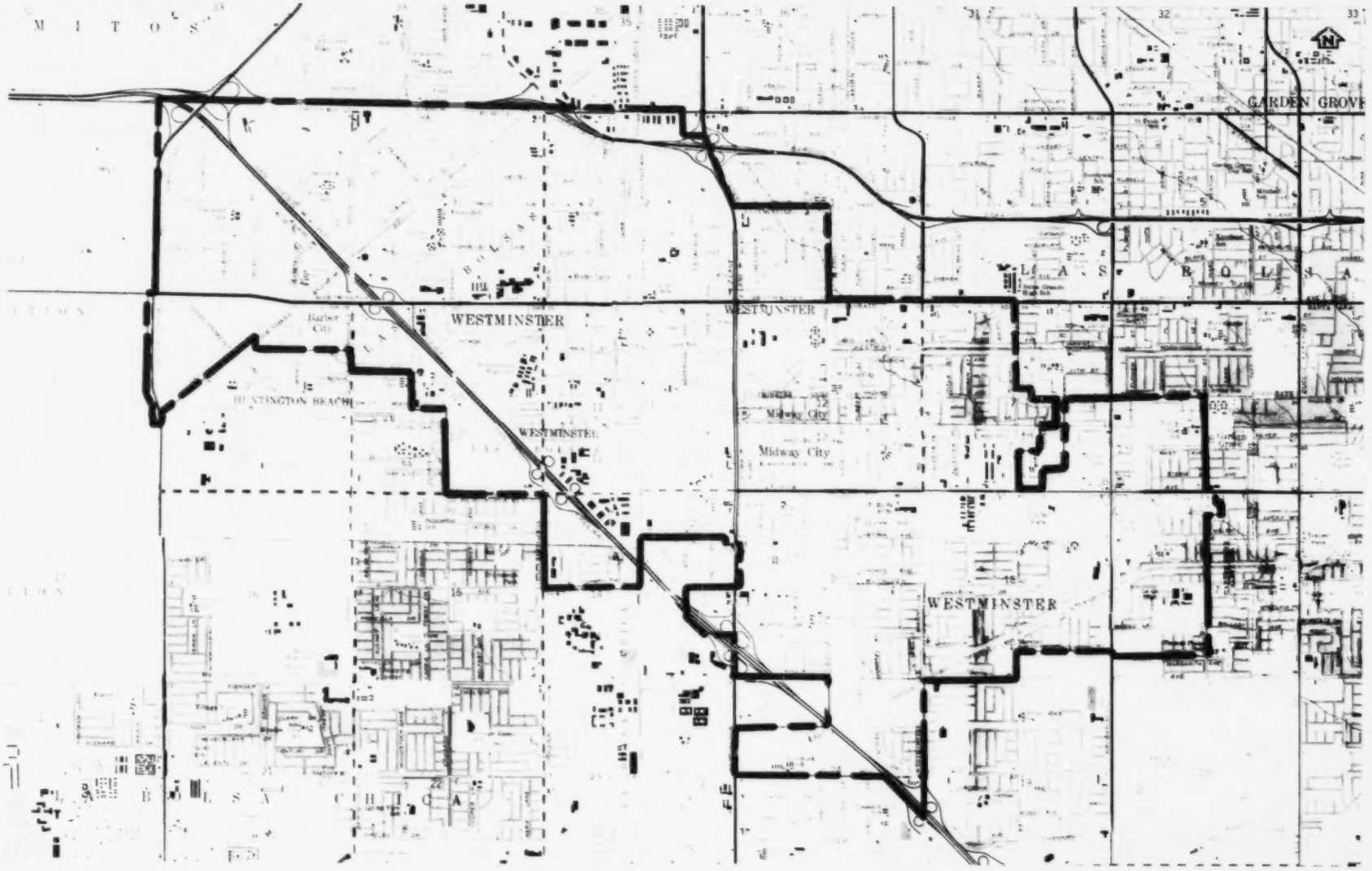

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER, CA
(ORANGE CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

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2.3 Principal Flood Problems

The principal flood problem for this study is lower Santa Ana River. The existing channel capacity is not sufficient to safely convey the 100-year flood. Excess flows will breach the channel at several locations and will cause widespread flooding in the Cities of Westminster, Garden Grove, Santa Ana, Costa Mesa, Fountain Valley and Huntington Beach, and in adjacent unincorporated areas.

The largest recorded flood for Santa Ana River occurred in March 1938. The peak flow reached approximately 100,000 cubic feet per second (cfs), which was approximately a 140-year frequency flood, and caused damages of approximately $4 million (1938 price level) in Orange County. The next major flood on Santa Ana River occurred in February 1969 and caused approximately $13 million in damage in Orange County. This was a 40-year frequency flood that would have caused more damage if Prado Dam had not been constructed in 1941. Damage from the 1969 flood was greater than from the 1938 flood mainly due to increased development and inflation.

A minor flood occurred on Santa Ana River in February 1980, that caused considerable damage to the channel banks. This flood is estimated to be a 5-year event with a maximum discharge of approximately 10,000 cfs.

Minor flooding in Westminster will also result during a 100-year flood along various drainage channels which cross the community.

2.4 Flood Protection Measures

Lower Santa Ana River has been improved by the Orange County Flood Control District, which has since been reorganized into the Orange County Environmental Management Agency. The improvement consists of a trapezoidal channel with concrete or riprap sides and an earthen invert, with drop structures and grade stabilizers at several locations.

The U.S. Army Corps of Engineers constructed Prado Dam upstream of the area under consideration in this study. The dam-channel combination is not adequate for the safe conveyance of the 100-year flood. The capacity of the channel is severely reduced by the constrictions caused by several bridges and by the lack of revetment on the upper portion of the levee for a major portion of the study reach. On the Santa Ana River flood plain, the Orange County Environmental Management Agency has improved several major tributary watercourses. These channels were designed to have adequate capacity to convey local runoff, but were not designed to intercept and convey the 100-year overflow from Santa Ana River. It was determined that the combined capacity of these local channels will not materially reduce the flooding from Santa Ana River overflow.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

The 100-year discharges on Santa Ana River were based on hydrology studies previously developed by the U.S. Army Corps of Engineers for the survey investigation of Santa Ana River (Reference 1). These discharges apply only to flow in the channel, and do not apply to overflow areas.

Peak discharge-drainage area relationships for the Santa Ana River channel are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community.

The hydraulic analyses were accomplished in four main parts: sediment transport analysis, channel capacity analysis, breakout analysis, and overflow analysis. The following is a brief discussion of the methods used in the analyses and the results obtained.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Santa Ana River					
At Imperial Highway					
In Anaheim	2,306[1]	N/A	N/A	50,000	N/A
At Katella Avenue					
In Orange	2,346[1]	N/A	N/A	50,000[2]	N/A
At Mouth	2,447[1]	N/A	N/A	12,000[2]	N/A

[1] 2,255 Square Miles Controlled by Prado Dam
[2] Reduction in Discharge Due to Santa Ana River Overflow

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Sediment Transport Analysis

Loss of channel capacity because of sedimentation has been recognized as a major problem on the most downstream end of the Santa Ana River. Consequently, a sediment transport analysis was conducted to estimate the change in streambed profile associated with the 100-year flood. It was felt that enough sedimentation data were available from the 1969 flood to make the analysis defendable. The U.S. Army Corps of Engineers HEC-6 Sediment Transport Computer Program was used to perform the computations (Reference 2). Because the channel is very inadequate, it was decided to use the HEC-6 program to obtain a starting condition fixed-bed mode for the determination of channel capacities.

Sediment samples were taken from the streambed at several locations to provide necessary data. Initial values of hydraulic and sediment transport parameters were computed and then calibrated using data from the 1969 flood, which constituted a 40-year event. Acceptable reproduction of the streambed profile observed after the flood was obtained for the majority of the study area. The calibrated parameters were then applied to the 100-year flood to determine the associated streambed profile.

The results of the analysis indicate that up to 4 feet of deposition in the channel will occur from Edinger Avenue to the Pacific Ocean. Deposition is also indicated between drop structures and in the vicinity of Imperial Highway. The analysis also predicts that scour of up to 2 feet will occur in the middle of the study area, from Garden Grove Boulevard to McFadden Avenue.

Channel Capacity Analysis

The U.S. Army Corps of Engineers HEC-2 Water-Surface Profile Computer Program was used to perform the computations required to determine the capacity of the existing channel (Reference 3). The HEC-2 computer program was operated in a fixed-bed mode, using the 100-year sediment profile obtained from the HEC-6 computer program which was operated in a moveable-bed mode. The necessary data required to describe the existing channel configuration were taken from the Orange County Environmental Management Agency construction plans. Bridge data were taken from construction plans provided by the Orange County Road Department and the California Department of Transportation.

A freeboard value of 1.25 feet was adopted for use in determining channel capacity. This value is one-half the standard used by the U.S. Army Corps of Engineers for design of trapezoidal channels; and, if exceeded, it is considered to represent a 50-percent chance of levee failure by overtopping. The freeboard value was applied to either the top of the revetment on the channel sides or to

the general ground elevation outside the levee, whichever was higher. For most of the study reach, the upper portion of the channel levee is unprotected. Based on computations involving both permissible tractive force and maximum permissible velocity, it was assumed that the unprotected portion of the levee would erode when exposed to long-duration flows such as would occur during the 100-year flood.

Values of roughness coefficient (Manning's "n") for the channel bottom were determined by an analysis of the predicted bed form. The values thus obtained for the channel bottom were combined with estimates of the Manning's "n" values for the revetment on the channel sides to obtain a composite value for the entire section. For the short stretch of river still unimproved (from near 17th Street to the Garden Grove Freeway) the roughness coefficient was estimated using Cowan's Method. The resulting Manning's "n" values range from 0.016 to 0.023 for the improved channel and 0.030 for the natural channel. No refinement in Manning's "n" values was made at bridges because the friction loss is negligible compared to pier losses and contraction and expansion losses.

The channel capacity was determined at all significant changes in conveyance and at all bridges. The capacities were determined by using the HEC-2 computer program to compute a rating curve at each selected location based upon a backwater analysis. Discharge values from 2,000 cfs to the peak 100-year discharge of 50,000 cfs were used.

The results of the analysis indicate that the channel capacity ranges between 15,000 and 20,000 cfs from the San Diego Freeway to Garden Grove Boulevard, between 30,000 and 40,000 cfs from the San Diego Freeway to the Pacific Ocean, between 40,000 and 50,000 cfs from Katella Avenue to the Santa Ana Freeway, and in excess of 50,000 cfs upstream of Katella Avenue.

Breakout Analysis

The location and magnitude of flow breaking out of the channel were determined using the results of the channel capacity analysis. It was assumed that the levee would fail at the water-surface elevation used to define the channel capacity and that the levee would erode sufficiently to allow all flow in excess of the capacity of the entrenched portion of the channel to break away from the river.

Locations of breakouts that will result in damage during the 100-year flood are listed in Table 2.

In all cases, the ground on the flood plain slopes away from the channel, so that none of the excess flow will return to the river.

Table 2. Santa Ana River Overflow

Location	100-Year Discharge (Cubic Feet per Second)	Direction of Flow
At Katella Avenue in Orange	5,000	Over West Bank
At Garden Grove Freeway (Upstream) in Orange	19,000	Over West Bank
At Garden Grove Freeway (Downstream) in Orange	1,000	Over Each Bank
At Santiago Creek in Santa Ana	4,000	Over East Bank
At Fairview Street in Santa Ana	3,000	Over West Bank
At Edinger Avenue in Santa Ana	3,000	Over Each Bank

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Overflow Analysis

In general, a simplified overflow analysis was necessary because of the extremely large area involved and because of the complex flow patterns caused by several major obstructions and very dense development with a large number of streets available for conveyance.

The general approach used in the analysis was as follows:

1. Using the results of the breakout analysis, principal flow paths and major obstructions were identified.

2. Hydraulic controls presented by the major obstructions were determined and the resulting flood depths upstream were computed. For example, rating curves were computed for weir flow over freeway embankments and flow at critical depth through constrictions presented by freeway underpasses.

3. The average inundation depth on the flood plain between major controls was determined by assuming normal depth, using gross cross sections obtained from applicable U.S. Geological Survey topographic maps (Reference 4), and making allowance for obstructions presented by the dense development.

4. Allowance was made for some of the flood being intercepted by major local drainage channels and being lost due to peak attenuation (route-down) of the flood wave caused by the large amount of storage available on the affected flood plain. The Modified Puls method of flood routing was used to estimate the peak attenuation of the overflow.

5. The block walls surrounding many areas in the flood plain were not designed to resist forces caused by ponding and will collapse before significant depths of flooding occur.

In computing the average flood depth between major obstructions, a base Manning's "n" value for flow in streets and between buildings was estimated to be 0.1. To adjust for the obstruction provided by buildings, the following percentage reductions in effective flow width were estimated from aerial photographs of the subject area: for flow parallel to the general street direction, 50 percent; for flow perpendicular to the streets, 80 percent. The resulting adjusted Manning's "n" values were determined to be 0.2 and 0.5, respectively.

The results of the analysis indicated that the 100-year flood will inundate a large area from Katella Avenue in Orange to the Pacific Ocean. The average depth of inundation on the flood plain will be 3 feet, but localized depths in ponded areas or areas immediately upstream of major obstructions will range from 5 to 9 feet.

Flood profiles were drawn for the channel showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). Profiles for the flow in the channel are provided only for completeness of the study. It should be emphasized that because the overflow is independent of the channel flow, the profiles should not be used to determine base flood elevations; instead, the Flood Insurance Rate Map (Exhibit 2) should be used for that purpose.

Due to the nature of the overbank flooding, flood profiles for the overbank areas are inapplicable and are not shown for this study.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundary of the 100-year flood has been delineated using the flood elevations determined at each cross section taken in the overbank area; between cross sections, the boundary was interpolated using topographic maps at a scale of 1:24,000, with a contour interval of 5 feet (Reference 4).

Approximate flood boundaries in some portions of the study area were taken from the Flood Hazard Boundary Map (Reference 5).

Flood boundaries are indicated on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood boundary corresponds to the boundary of the areas of special flood hazards (Zones A, and A0).

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights.

Because the 100-year flood on Santa Ana River leaves the channel and does not return, the overflow is considered to be independent of the channel flow. The concept of the floodway is not applicable in this case; therefore, no floodway is shown in this study.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Emergency Management Agency has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Westminster.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Emergency Management Agency device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

Since the 100-year overbank flow along Santa Ana River is independent of the channel flow, the usual procedure of determining Flood Hazard Factors and reaches is not entirely applicable to the study area. Instead of using the 10-year flood elevation, the ground-surface elevation was used in conjunction with the 100-year elevation in determining the FHF and the reach.

5.3 Flood Insurance Zones

The entire incorporated area of the City of Westminster was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or Flood Hazard Factors determined.
Zone A0:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no Flood Hazard Factors are determined.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

For this study, the majority of the flood plain will be inundated to depths of 1 to 3 feet and is, therefore, designated as an AO Zone.

The flood insurance zones and base flood elevations for the Santa Ana River overflow areas are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Westminster is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Emergency Management Agency.

6.0 OTHER STUDIES

Flood Insurance Studies for the Cities of Garden Grove (Reference 6), Fountain Valley (Reference 7), and Huntington Beach (Reference 8) will agree exactly with the results of this study. A Flood Insurance Study for the unincorporated areas of Orange County (Reference 9) was published in September 1979. The results of this study do not include the detailed analysis of Santa Ana River overflow presented here. Revisions to this previously published study are in progress and the revised study will be in agreement with this study.

A Flood Hazard Boundary Map for Westminster was published on June 14, 1974, and revised on July 2, 1976, and November 15, 1977 (Reference 5). This study represents a more thorough analysis than the previously published map, and, therefore, supersedes it.

A previous Flood Insurance Rate Map for Westminster was published on August 8, 1978 (Reference 10). In this earlier study, Westminster was identified as a minimal flood-prone community. The present study represents a more detailed analysis, and, therefore, supersedes the previously published study.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 211 Main Street, Room 220, San Francisco, California 94105.

BEST DOCUMENT AVAILABLE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Santa Ana River Overflow Shallow Flooding	0005	N/A	N/A	N/A	N/A	AO	Depth 3

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER, CA
(ORANGE CO.)

FLOOD INSURANCE ZONE DATA

SANTA ANA RIVER OVERFLOW

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6. Federal Emergency Management Agency, Flood Insurance Study, City of Garden Grove, California, unpublished

7. Federal Emergency Management Agency, Flood Insurance Study, City of Fountain Valley, California, August 1981

8. Federal Emergency Management Agency, Flood Insurance Study, City of Huntington Beach, California, August 1981

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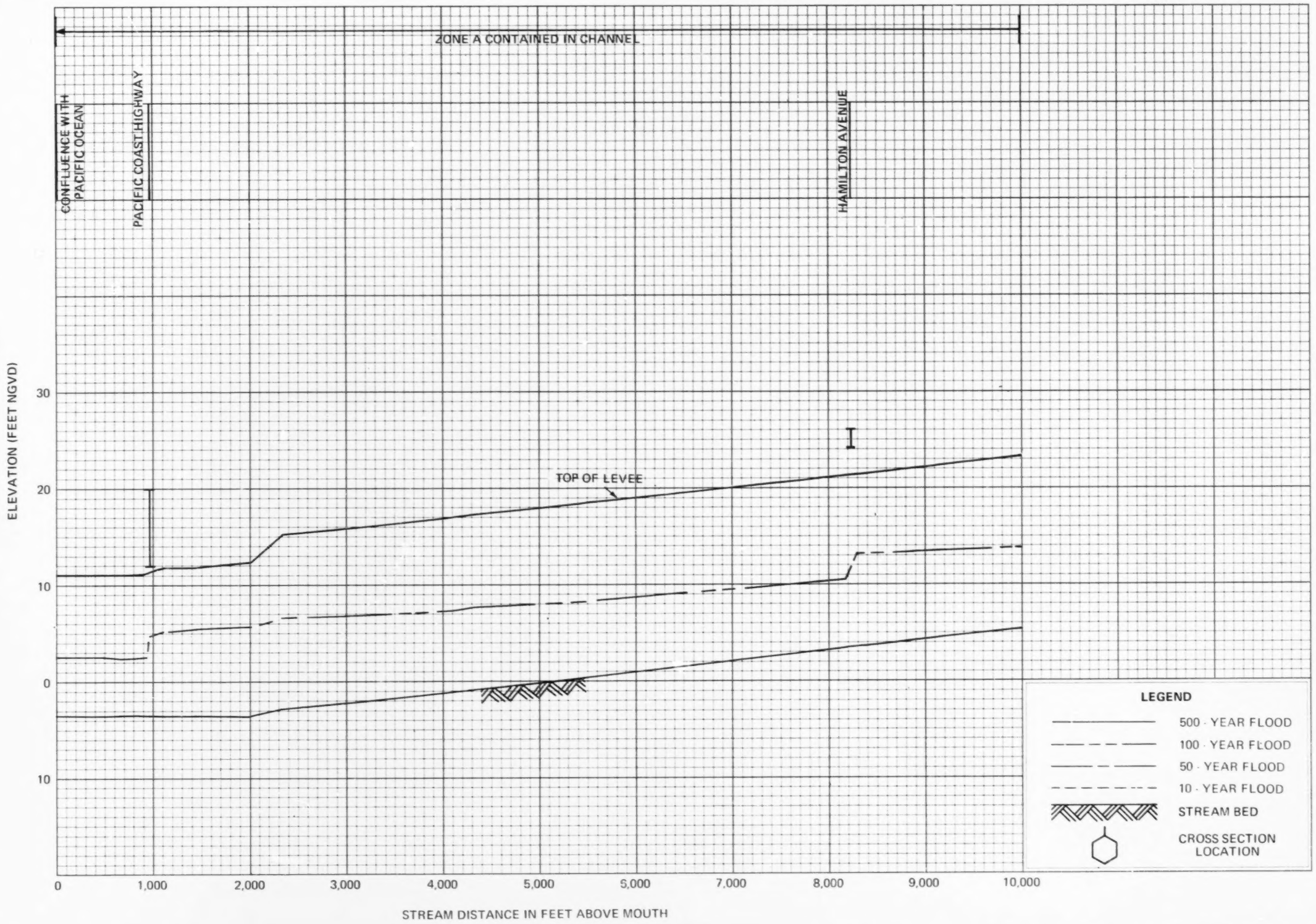
10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Rate Map, City of Westminster, California, Scale 1:12,000, August 8, 1978



FLOOD PROFILES

SANTA ANA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSTA MESA, CA
CITY OF WESTMINSTER, CA
CITY OF GARDEN GROVE, CA
CITY OF FOUNTAIN VALLEY, CA
CITY OF HUNTINGTON BEACH, CA
(ORANGE CO.)

01P

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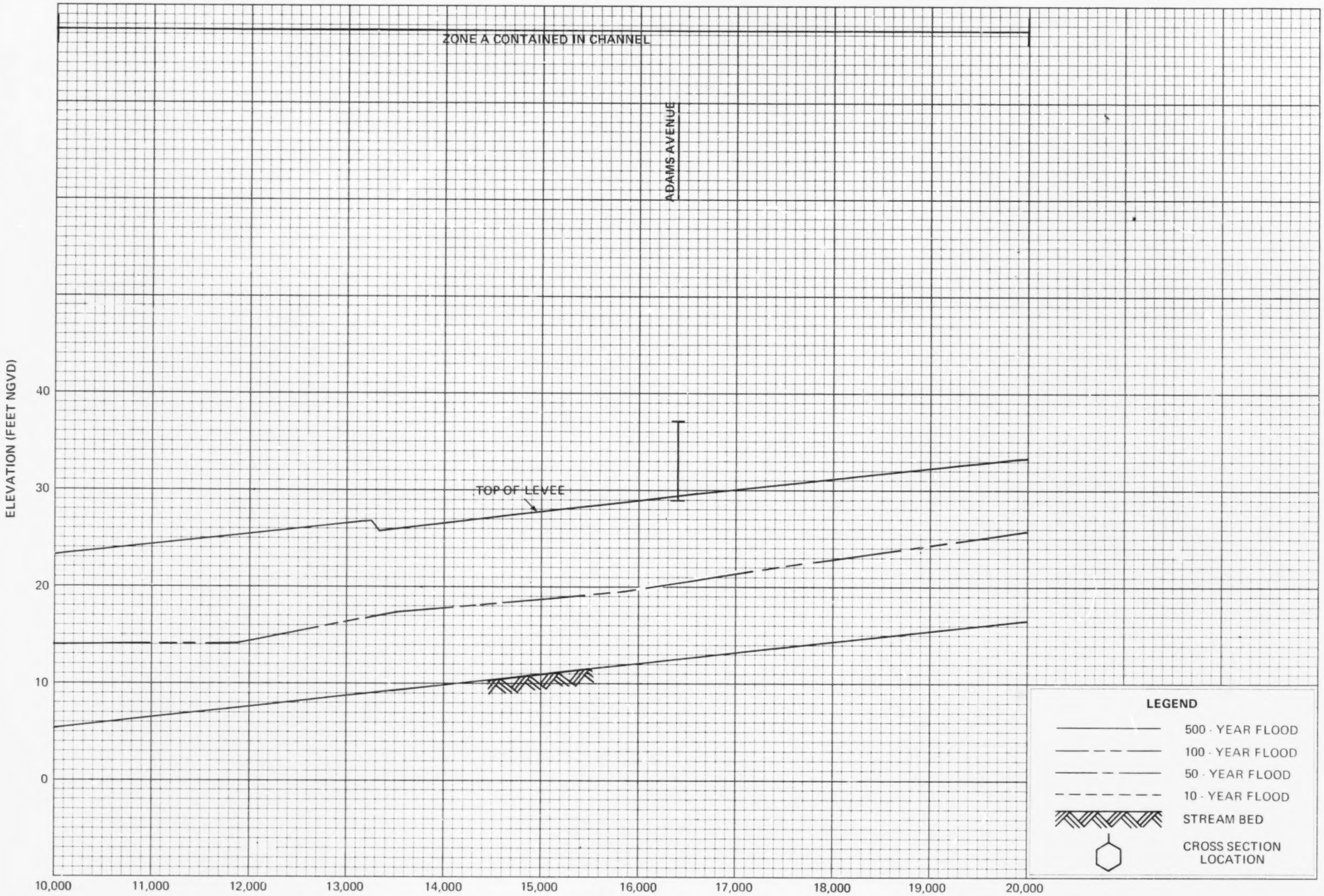

FLOOD PROFILES

SANTA ANA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSTA MESA, CA
CITY OF WESTMINSTER, CA
CITY OF GARDEN GROVE, CA
CITY OF FOUNTAIN VALLEY, CA
CITY OF HUNTINGTON BEACH, CA
(ORANGE CO.)

02P

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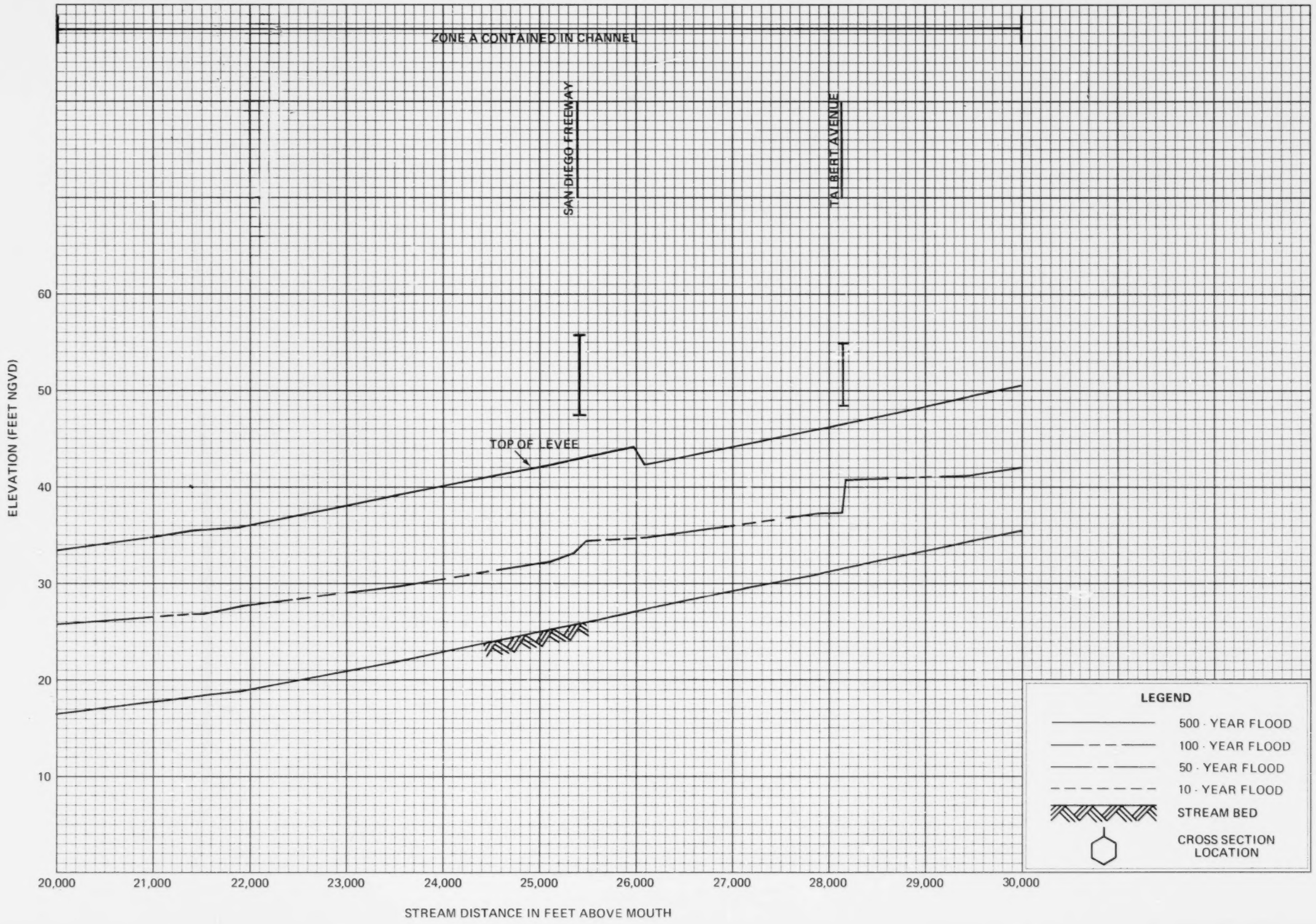

FLOOD PROFILES

SANTA ANA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSTA MESA, CA
CITY OF WESTMINSTER, CA
CITY OF GARDEN GROVE, CA
CITY OF FOUNTAIN VALLEY, CA
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(ORANGE CO.)

03P

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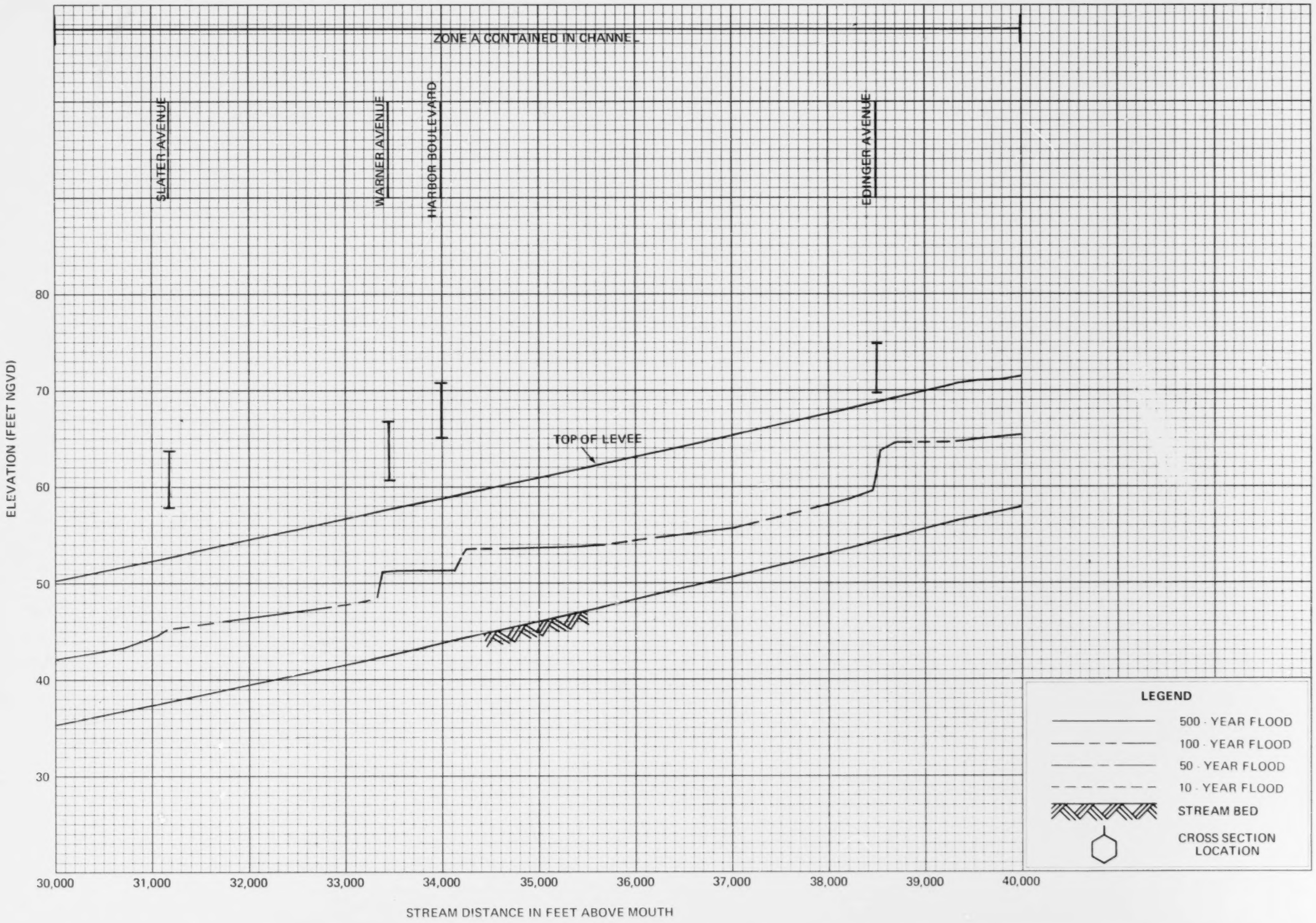

FLOOD PROFILES

SANTA ANA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSTA MESA, CA
CITY OF WESTMINSTER, CA
CITY OF GARDEN GROVE, CA
CITY OF FOUNTAIN VALLEY, CA
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(ORANGE CO.)

04P

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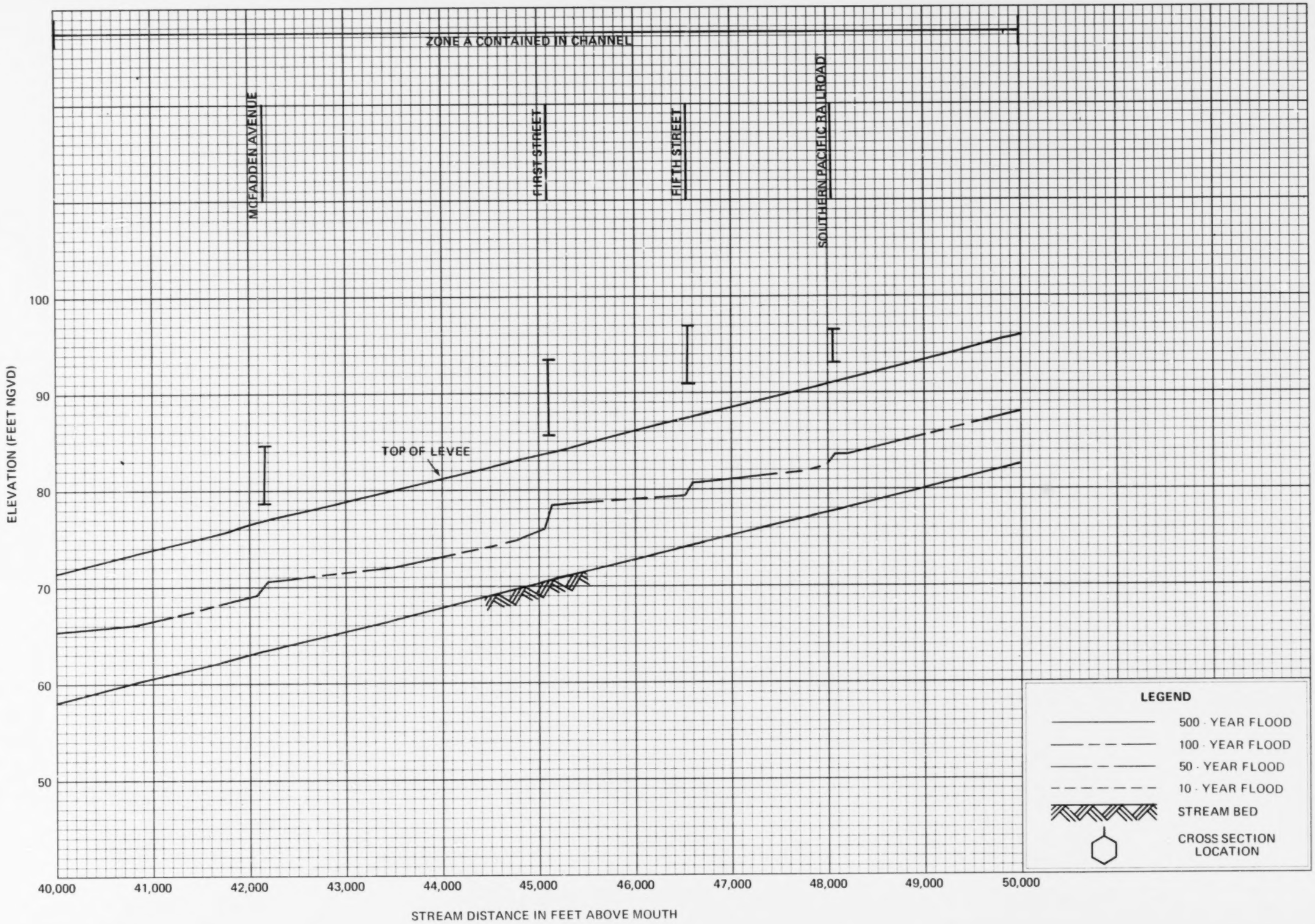

FLOOD PROFILES

SANTA ANA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF COSTA MESA, CA
CITY OF WESTMINSTER, CA
CITY OF GARDEN GROVE, CA
CITY OF FOUNTAIN VALLEY, CA
CITY OF HUNTINGTON BEACH, CA
(ORANGE CO.)

05P

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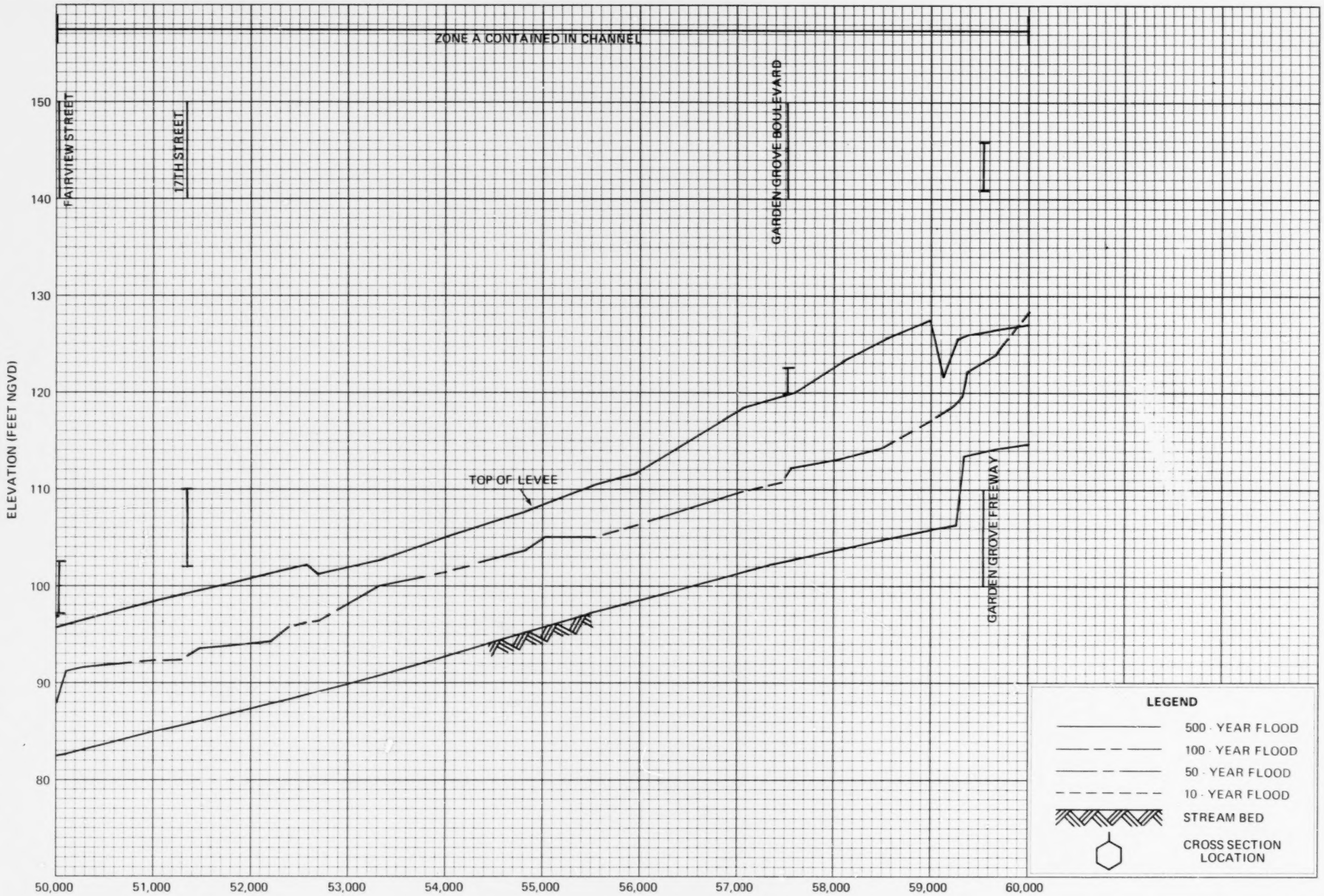

FLOOD PROFILES

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06P

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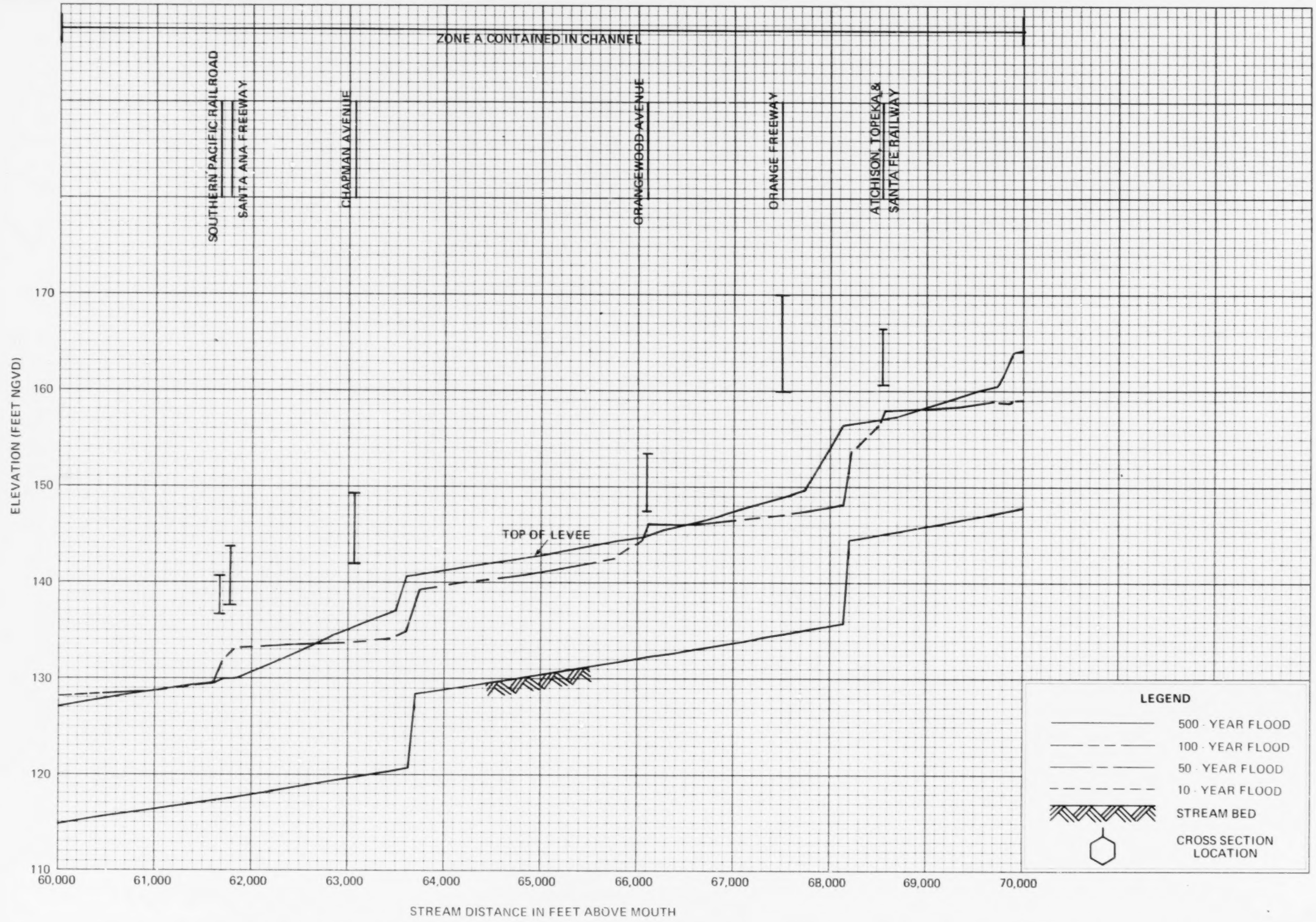

FLOOD PROFILES

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07P

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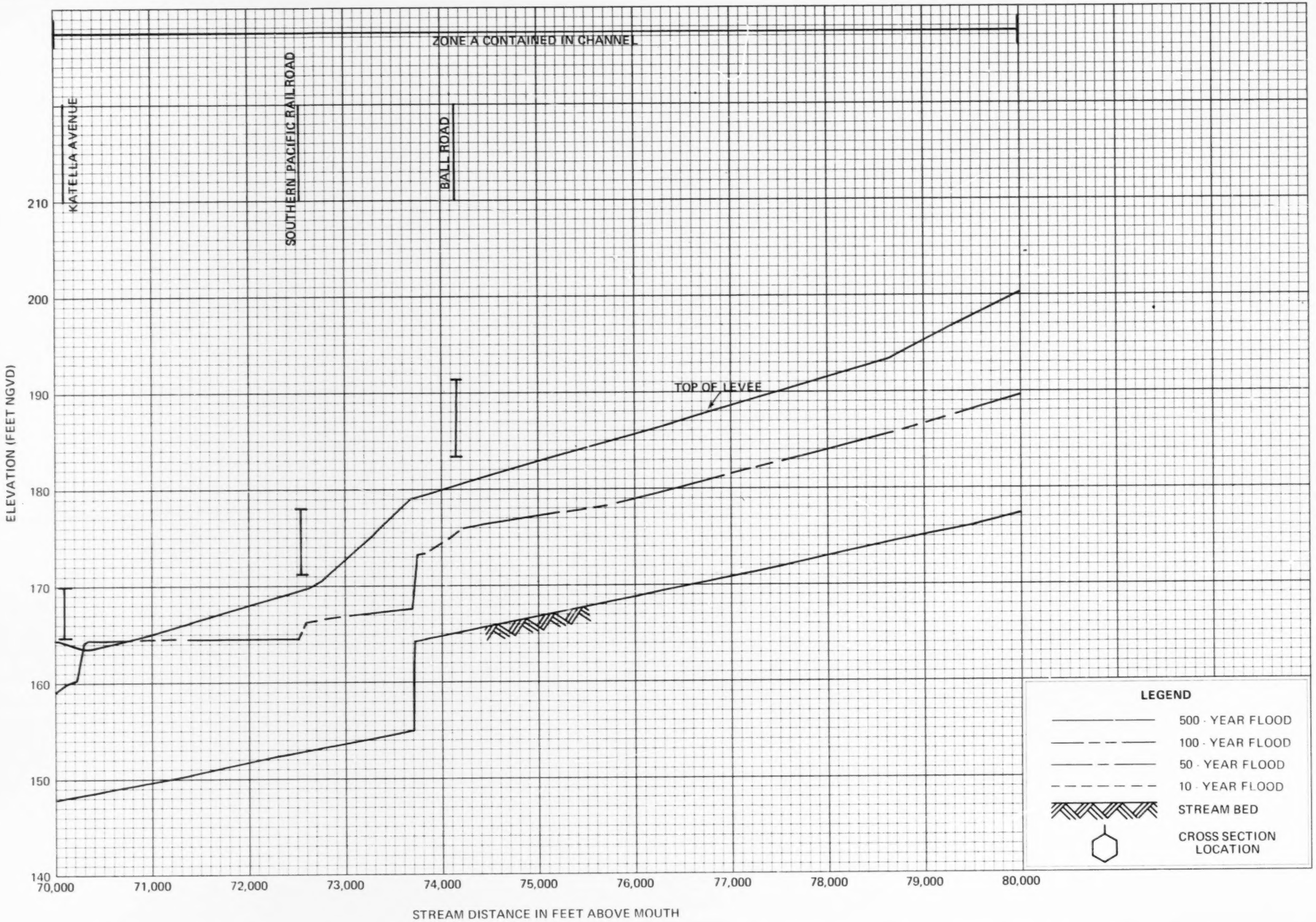

FLOOD PROFILES

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08P

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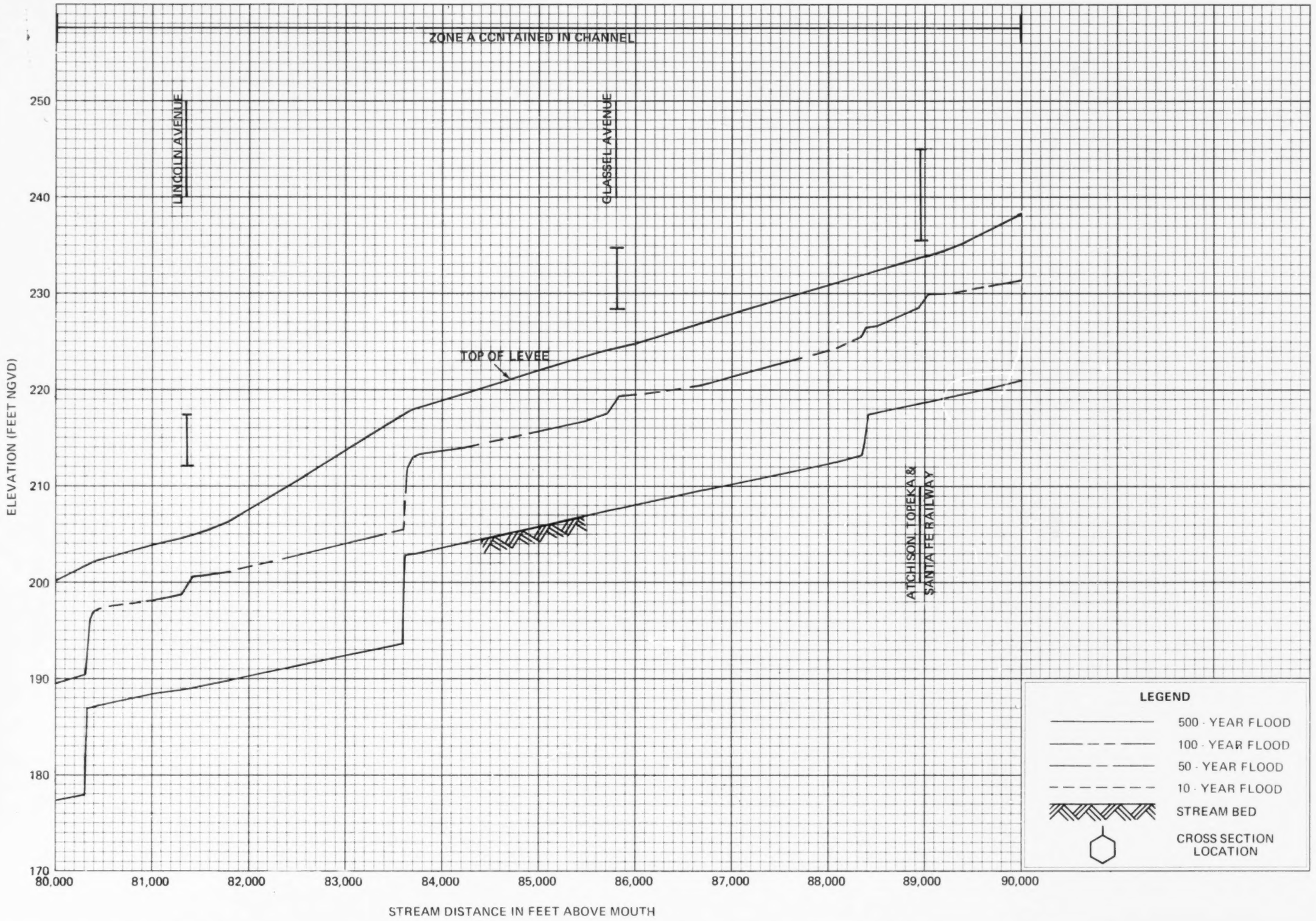

FLOOD PROFILES

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09P

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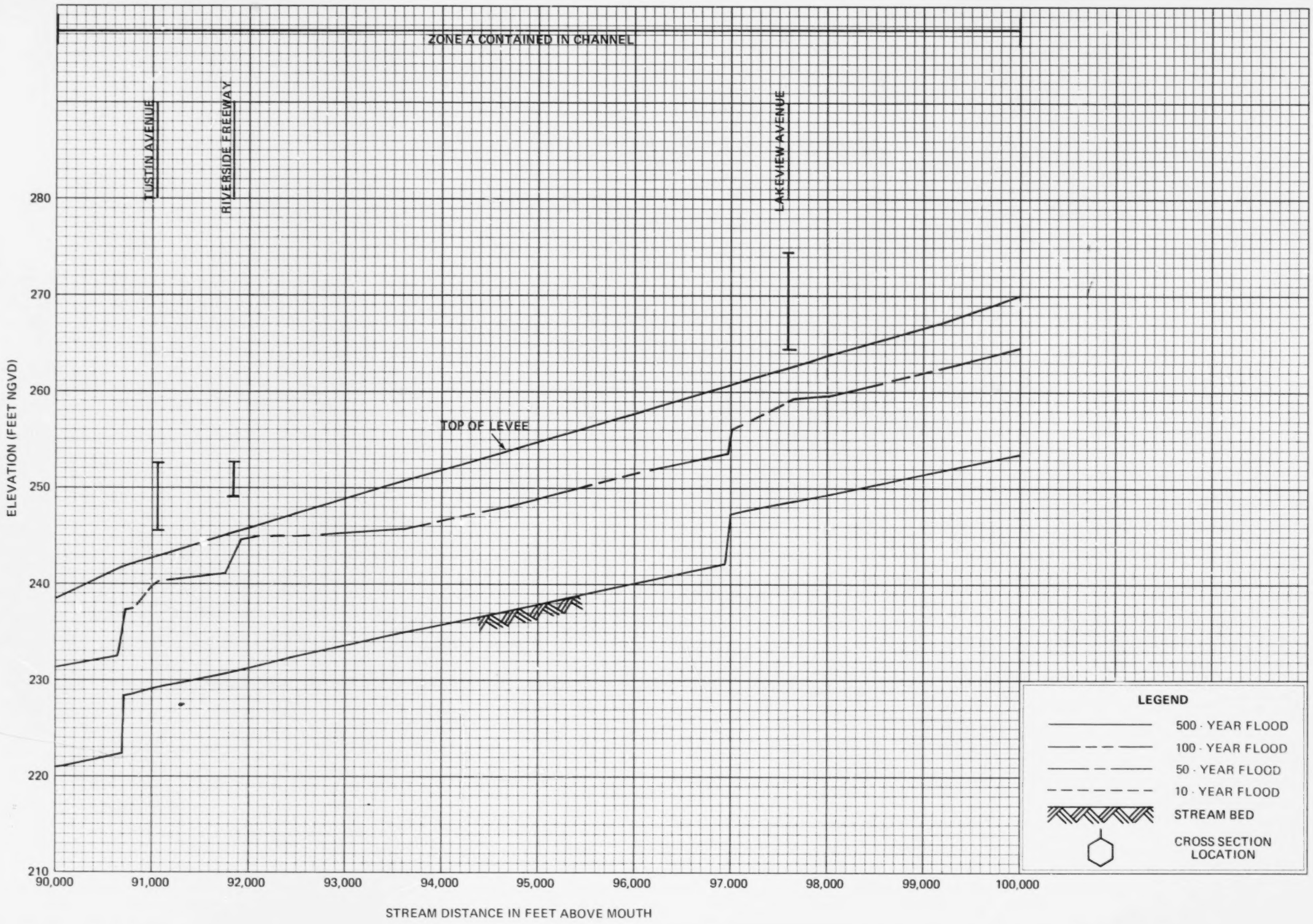

FLOOD PROFILES

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10P

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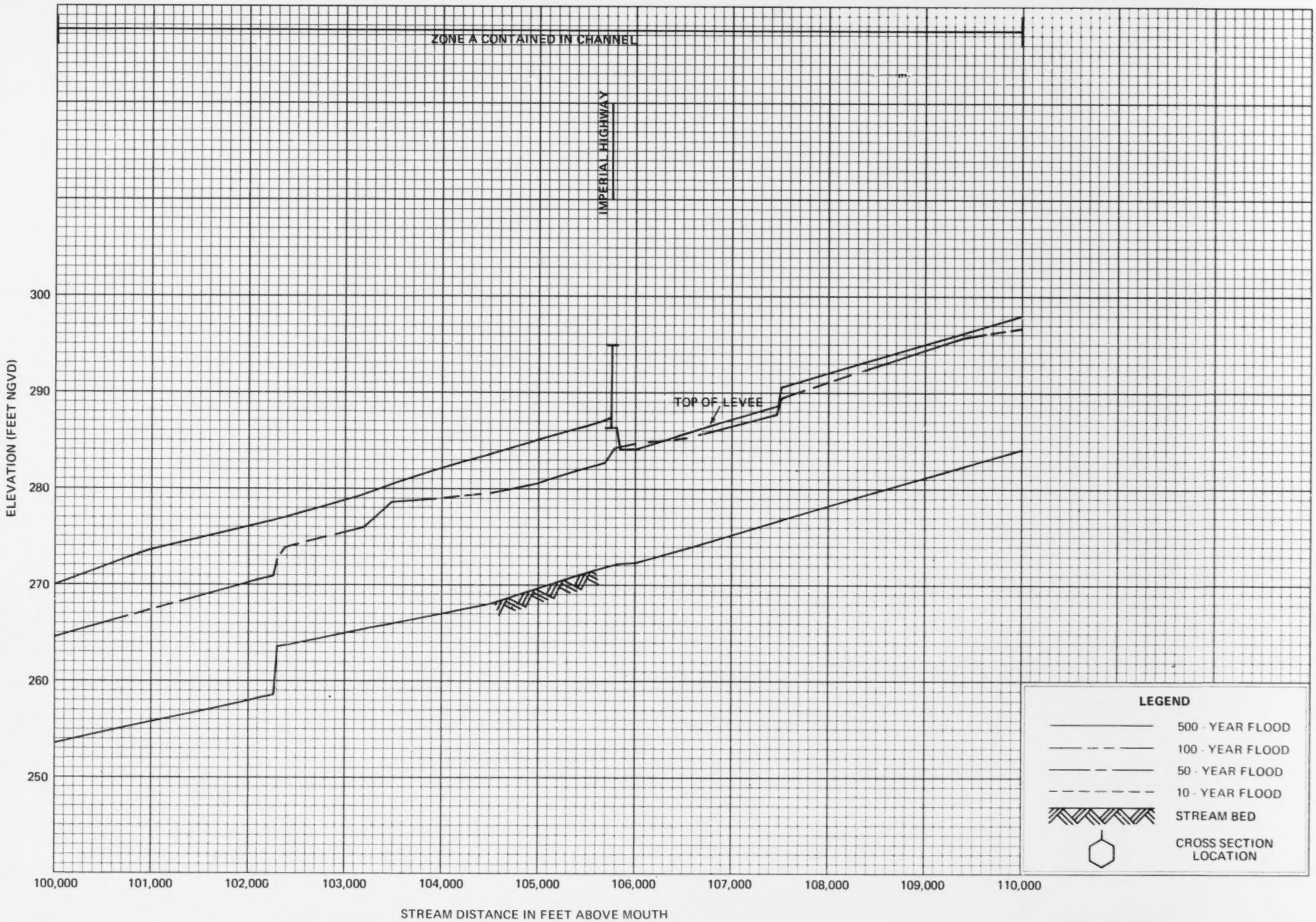

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11P

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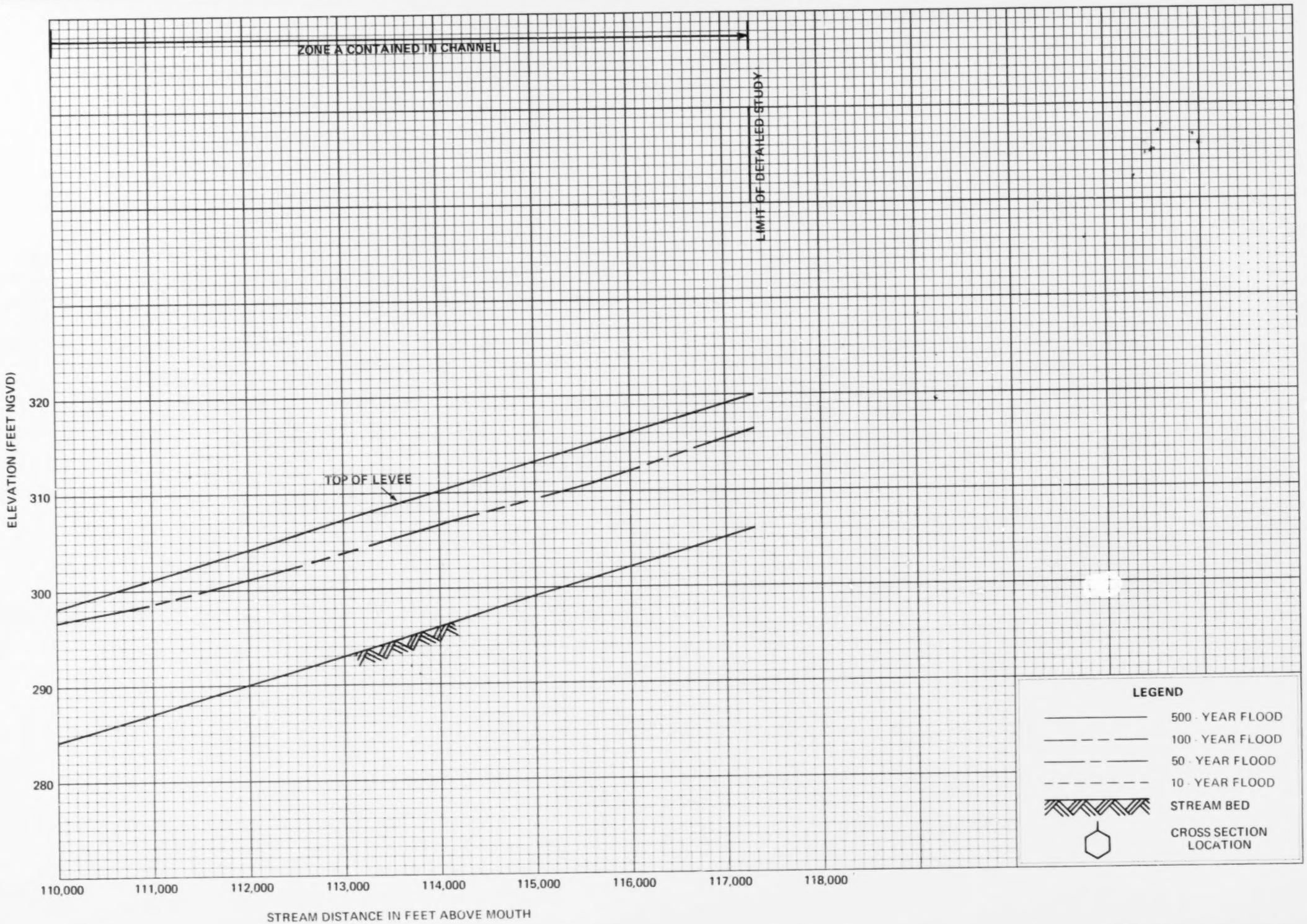

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